

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

DOE /NASA CONTRACTOR REPORT

DOE/NASA CR-150732

SOLAR HEATING AND COOLING SYSTEMS DESIGN AND DEVELOPMENT (Quarterly Report)

Prepared by

Honeywell, Inc.
2600 Ridgway Parkway
Minneapolis, MN 55413

Under Contract NAS8-32093 with

National Aeronautics and Space Administration
George C. Marshall Space Flight Center, Alabama 35812

For the U. S. Department of Energy



(NASA-CR-150732) SOLAR HEATING AND COOLING
SYSTEMS DESIGN AND DEVELOPMENT Quarterly
Report, 1 Jan. - 31 Mar. 1978 (Honeywell,
Inc.) 20 p HC A02/MF A01 CSCL 10A

N78-28612

G3/44 Unclas
27153

U.S. Department of Energy



Solar Energy

NOTICE

This report was prepared to document work sponsored by the United States Government. Neither the United States nor its agents the United States Department of Energy, the United States National Aeronautics and Space Administration, nor any federal employees, nor any of their contractors, subcontractors or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represent that its use would not infringe privately owned rights.

FOREWARD

Honeywell was awarded Contract NAS8-32093 by the George C. Marshall Space Flight Center (MSFC) effective 9 July 1976.

The program calls for the development and delivery of eight (was 12) prototype solar heating and cooling systems for installation and operational test. Two (was 6) heating and six heating and cooling units will be delivered for single-family residences (SFR), multiple-family residences (MFR) and commercial applications.

Lennox Industries, Marshalltown, Iowa, and Barber-Nichols Engineering Company, Arvada, Colorado, are supporting Honeywell in subcontractor roles.

This document describes the progress of the program during the seventh program quarter, 1 January 1978 to 31 March 1978. It is submitted to MSFC for information per DR 500 Item 10 and can be made available to the general public.

TABLE OF CONTENTS

	<u>Page No.</u>
SECTION I SUMMARY	1-1
SECTION II SCHEDULES	2-1
SECTION III TECHNICAL STATUS	3-1
Kansas University -- Multifamily Heating and Cooling	3-1
COLLECTOR SUPPORT STRUCTURE	3-1
STORAGE TANK	3-1
New Castle, PA -- Single-Family Heating Only	3-2
Carrollton, TX -- Commercial Heating and Cooling	3-2
Heating and Cooling Complex Layout	3-3
Plumbing Layout in the Mechanical Room	3-3
Ocmulgee National Monument, GA - Light Commercial Heating and Cooling OTS#44	3-3
Sacramento, CA -- Single-Family Heating and Cooling OTS#41	3-6

LIST OF FIGURES

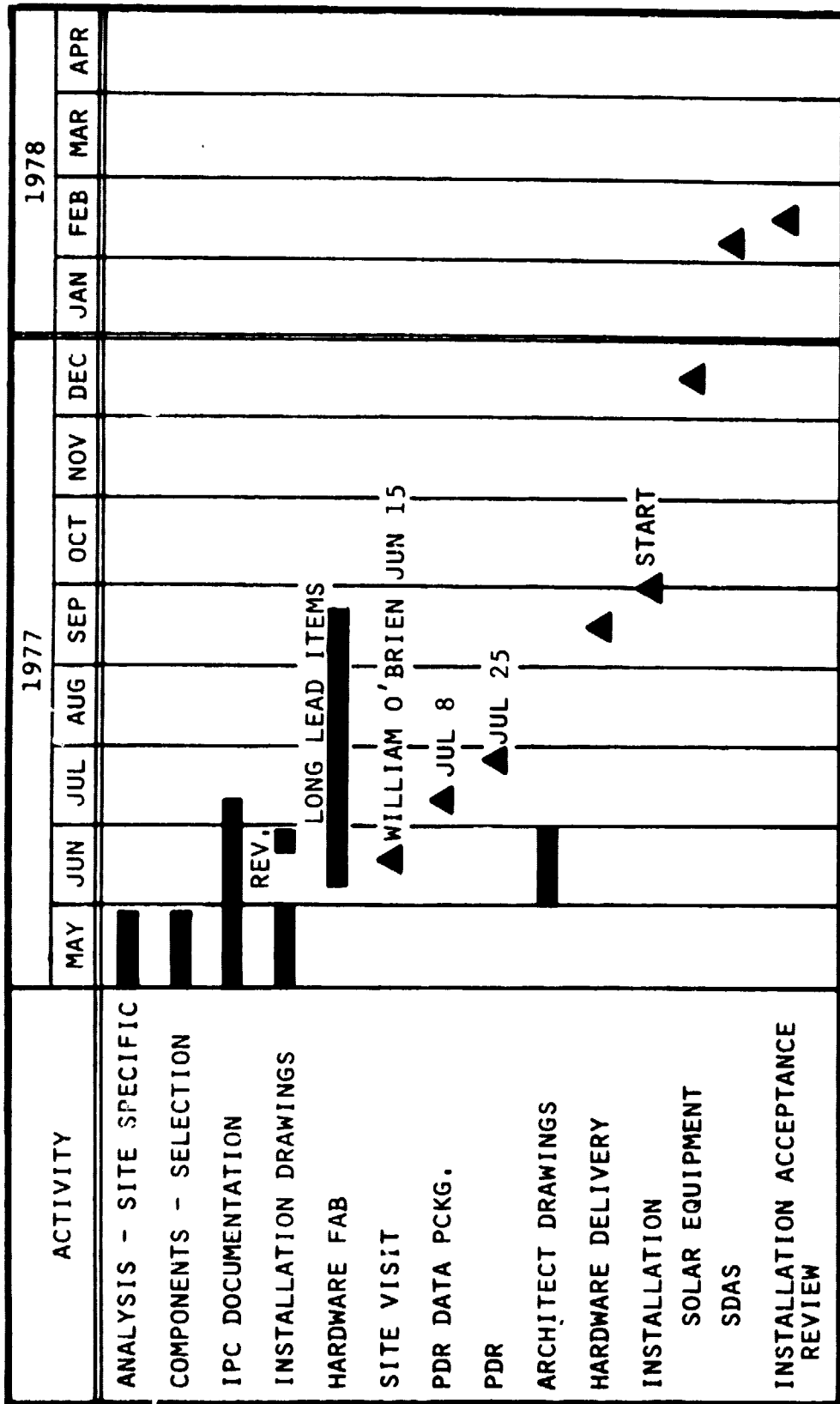
<u>Figure</u>	<u>Title</u>	<u>Page No.</u>
2-1	Single-Family Residence (Heating Only) Stillwater, Minnesota (OTS #40)	2-2
2-2	Single-Family Residence (Heating Only) New Castle, Pennsylvania (OTS #39)	2-3
2-3	Kansas University Multiple-Family Residence (OTS #43)	2-4
2-4	Single-Family Residence Heating and Cooling Site Sacramento, CA (OTS #41)	2-5
2-5	Single-Family Residence Heating and Cooling Site, Jacksonville, FLA. (OTS #42)	2-6
2-6	Commercial Heating and Cooling (Ocmulgee) (OTS #44)	2-7
2-7	Commercial Heating and Cooling (50 Ton Lennox) (OTS #45)	2-8
2-8	Commercial Heating and Cooling (75 Ton Unidentified) (OTS #46)	2-9
3-1	Collector Field	3-4
3-2	Preliminary Schematic of (18' x 12') Mechanical Room	3-5

SECTION I SUMMARY

The William O'Brien site is operational but the SDAS is still producing erroneous data. IBM is investigating the problem. Construction on the New Castle, Pennsylvania, site is now moving rapidly. It should be complete by the end of May if construction materials arrive. The Kansas University site design is complete, materials are arriving daily and bids for installation have been submitted to NASA for approval. Construction will begin by May 1 if all the contracts can be finalized by this time. The Carrollton, Texas, site design is 80 percent complete. The construction on the collector field will begin May 1. The remaining work will start at completion of the PDR and when ordered material arrives. The Sacramento site design has been initiated, and no significant problems have occurred to date. The 25-ton system design at Ocmulgee Monument has been initiated. This design should go smoothly with design completion scheduled by early summer of 78.

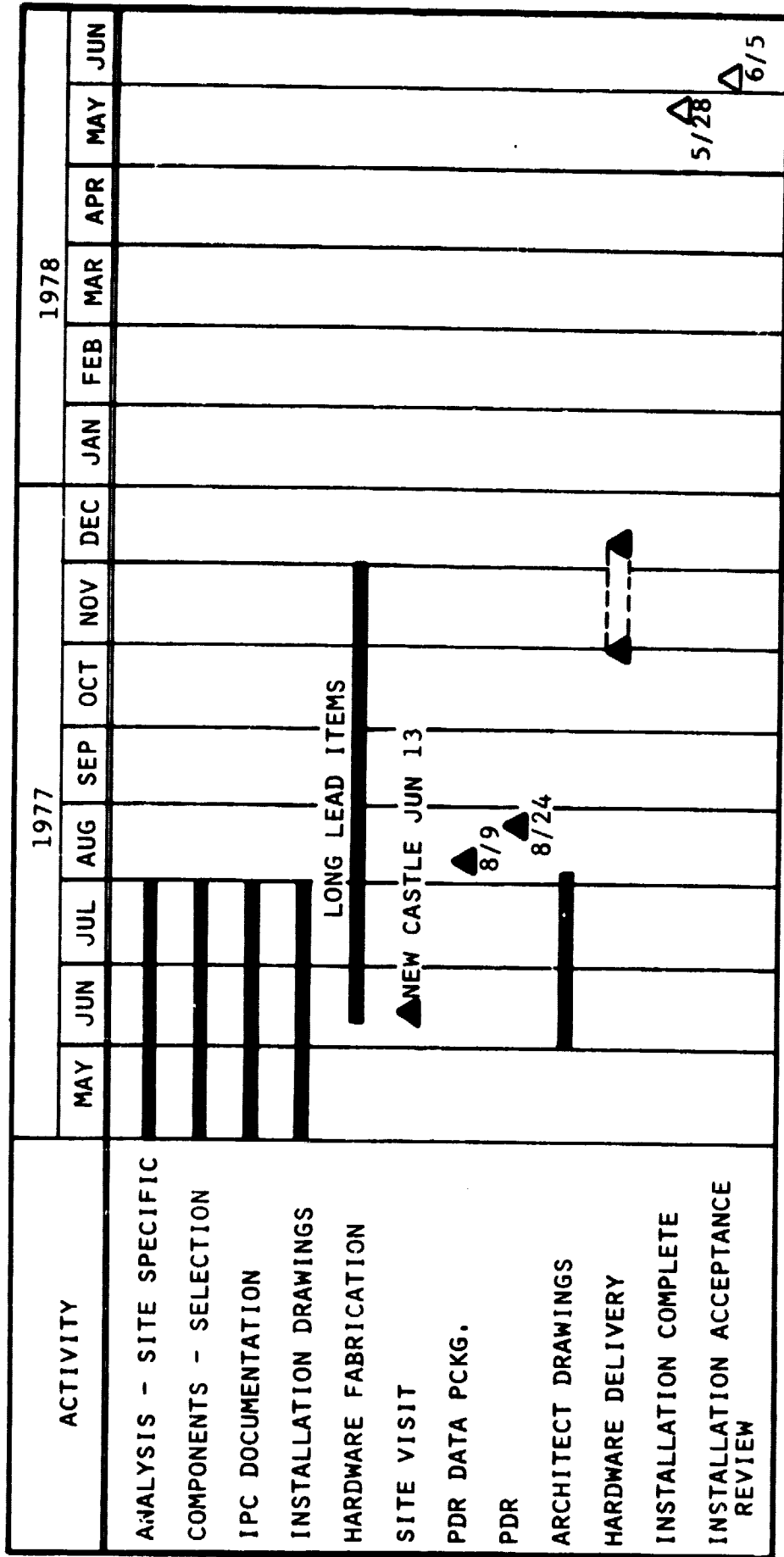
SECTION II SCHEDULES

Schedules for each deliverable hardware system are shown in Figures 2-1 through 2-8. Current status schedules for systems that have sites selected are depicted in Figures 2-1 through 2-5 and Figure 2-7. The schedules for the two unidentified sites are shown in Figures 2-6 and 2-8.



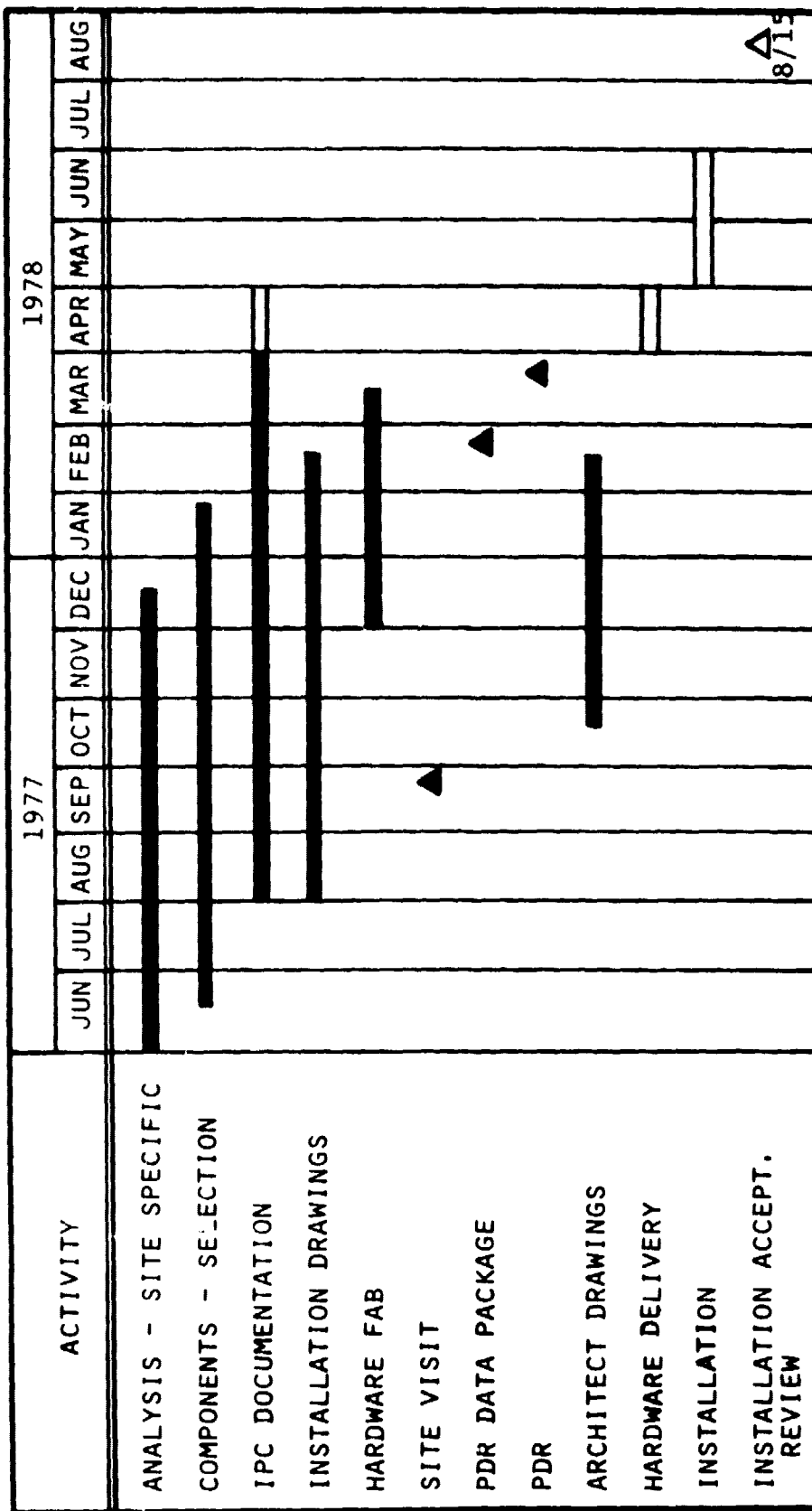
REVISED 3/31/78

Figure 2-1. Single-Family Residence (Heating Only) Stillwater, Minnesota (OTS #40)



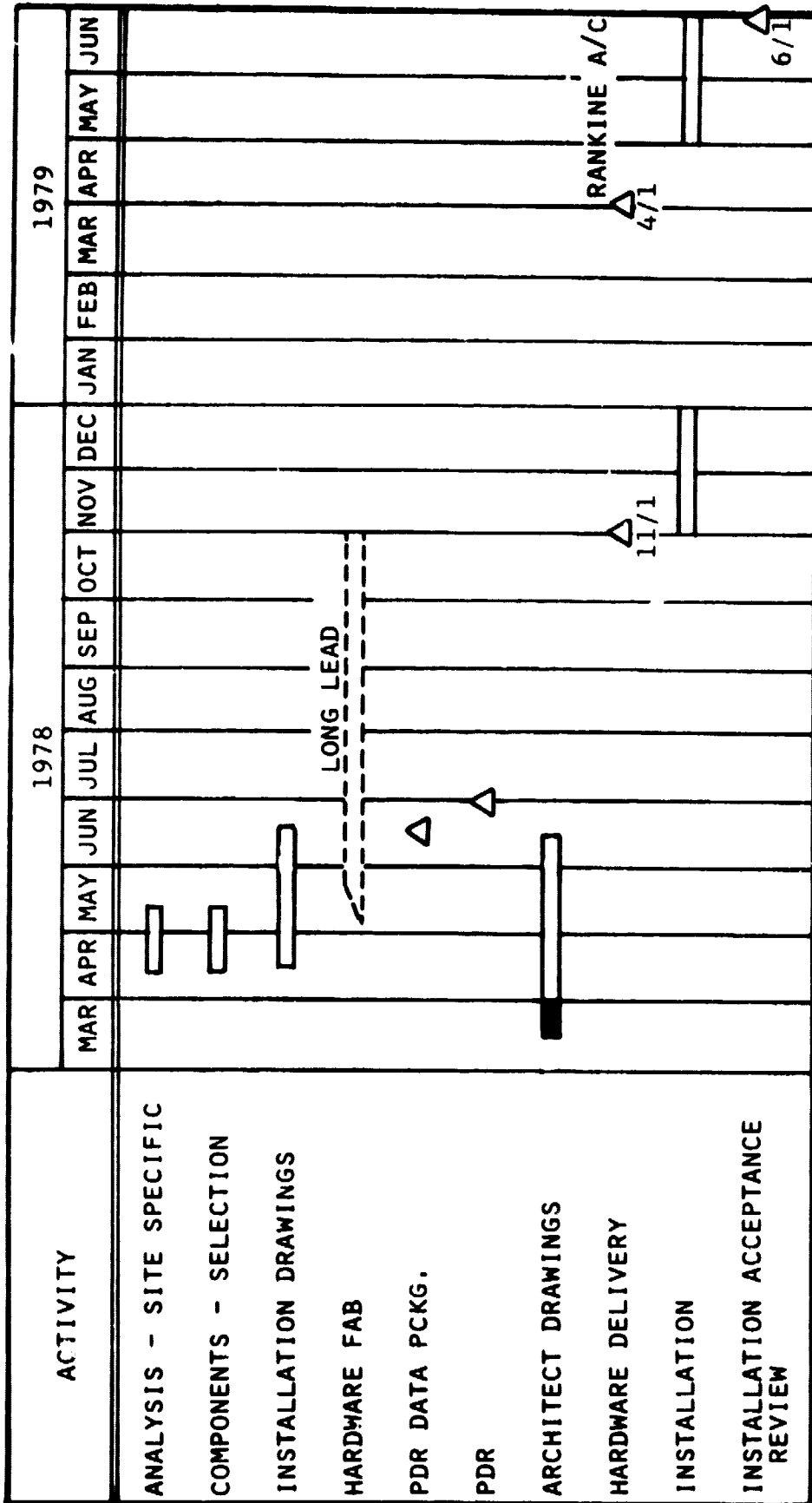
REVISED 3/31/78

Figure 2-2. Single-Family Residence (Heating Only) New Castle, Pennsylvania (OTS #39)



REVISED 3/31/78

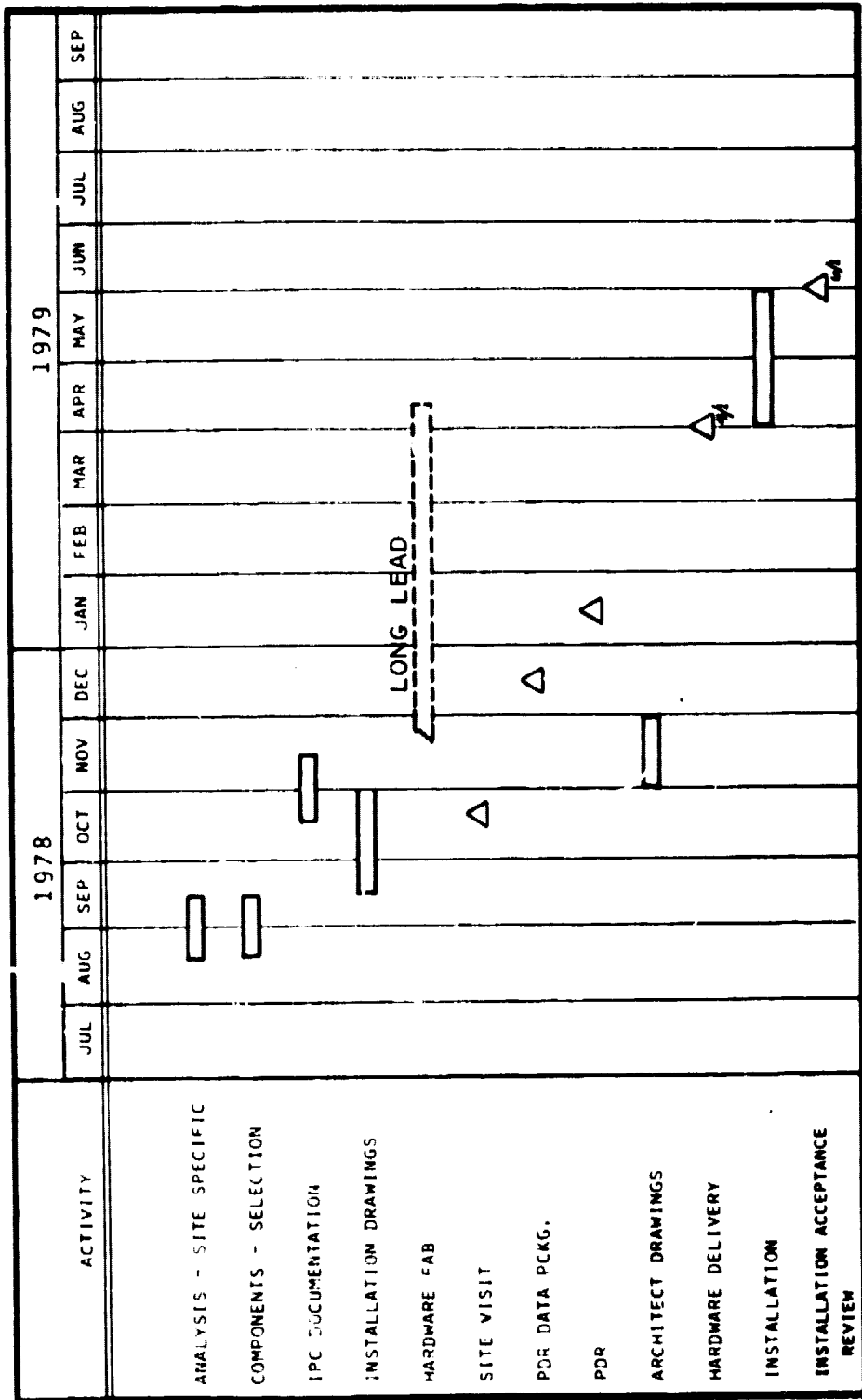
Figure 2-3. Kansas University Multiple-Family Residence (OTS #43)



REVISED BASED ON E.C.P. 005

REVISED 3/31/78

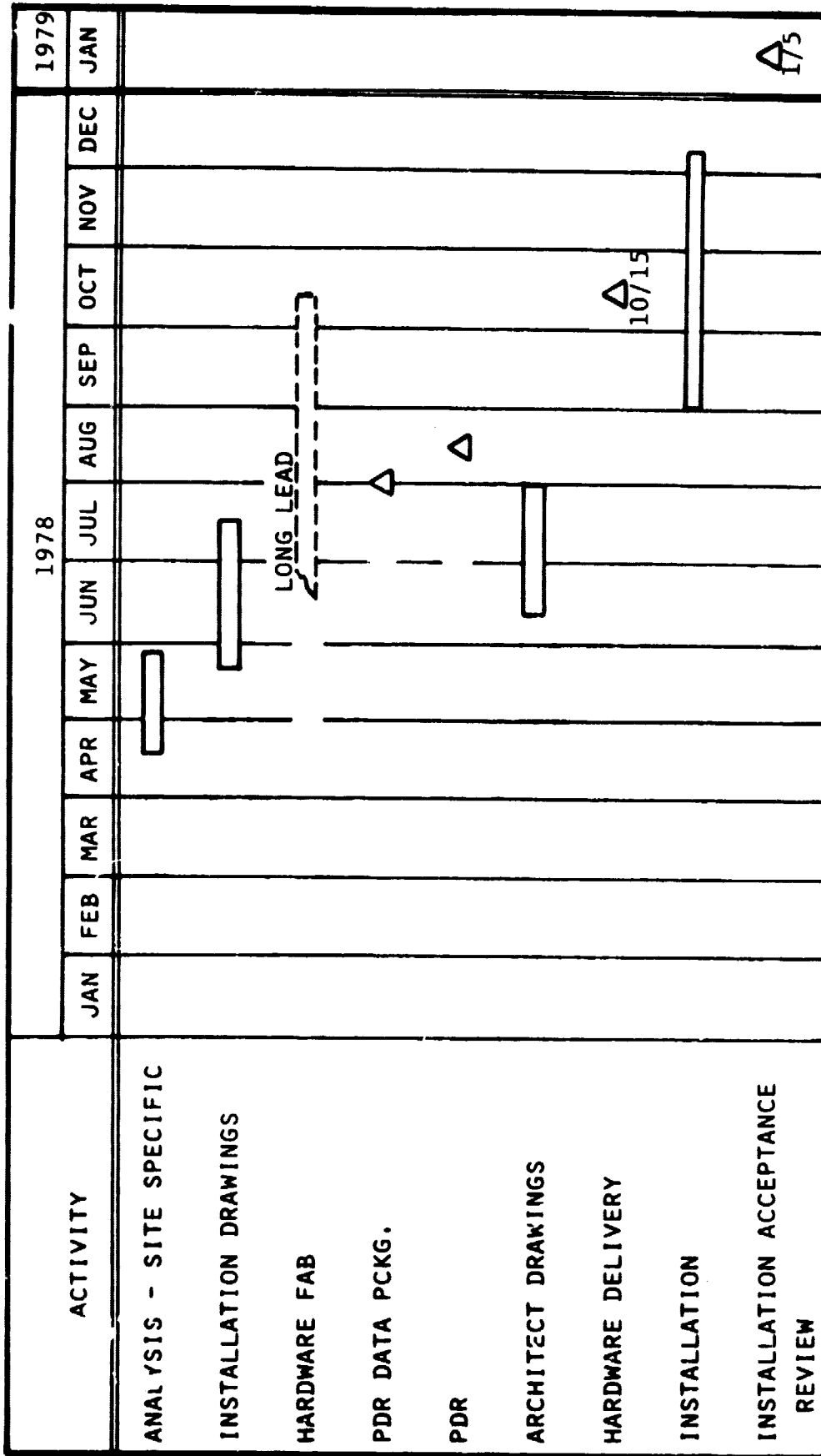
Figure 2-4. Single-Family Residence Heating and Cooling Site -- Sacramento, CA (OTS #41)



REVISED BASED ON E.C.P. 005

REVISED 3/31/78

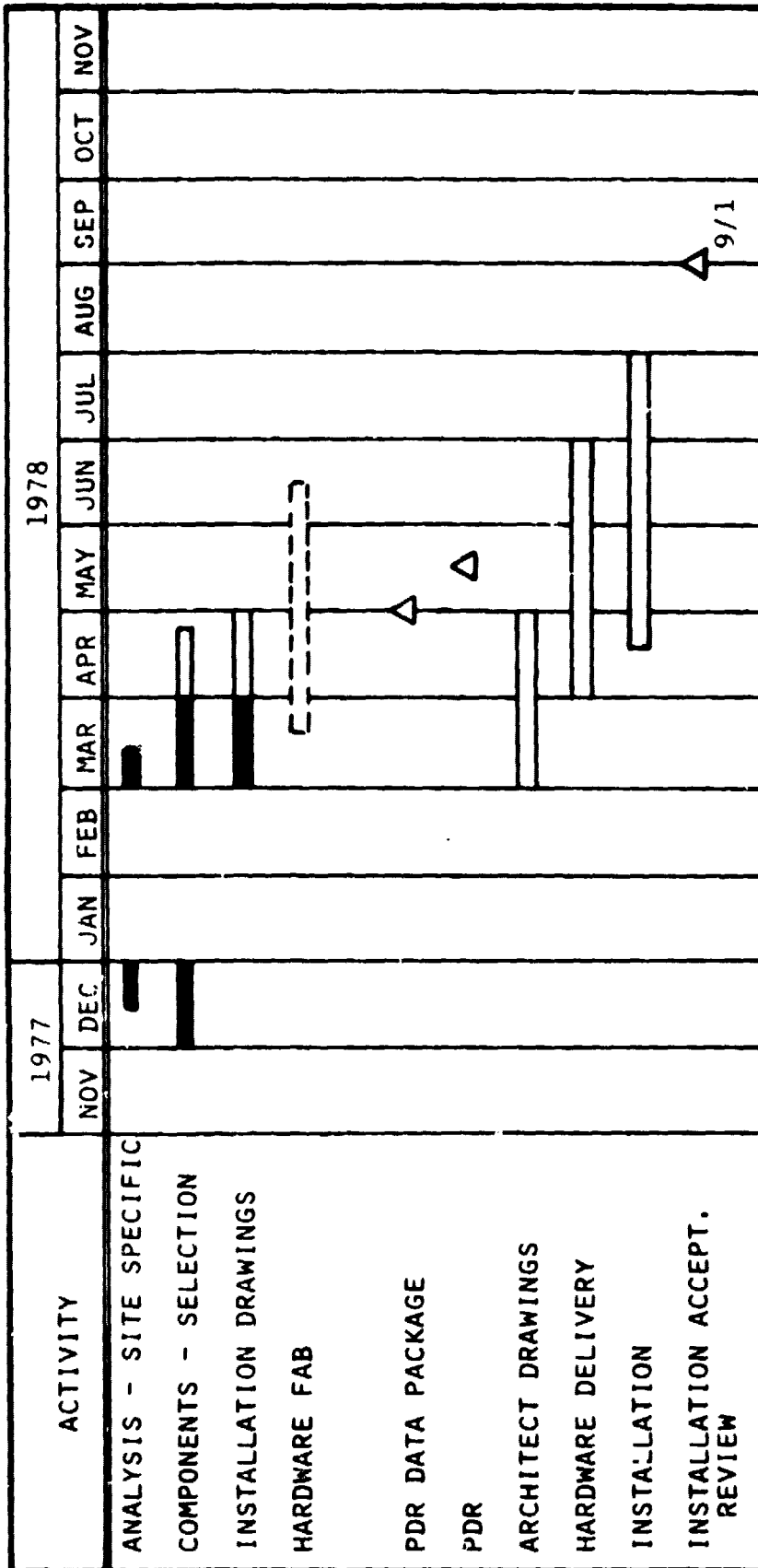
Figure 2-5. Single-Family Residence Heating and Cooling Site, Jacksonville, Fla. (OTS #42)



REVISED BASED ON E.C.P. 005

REVISED 3/31/78

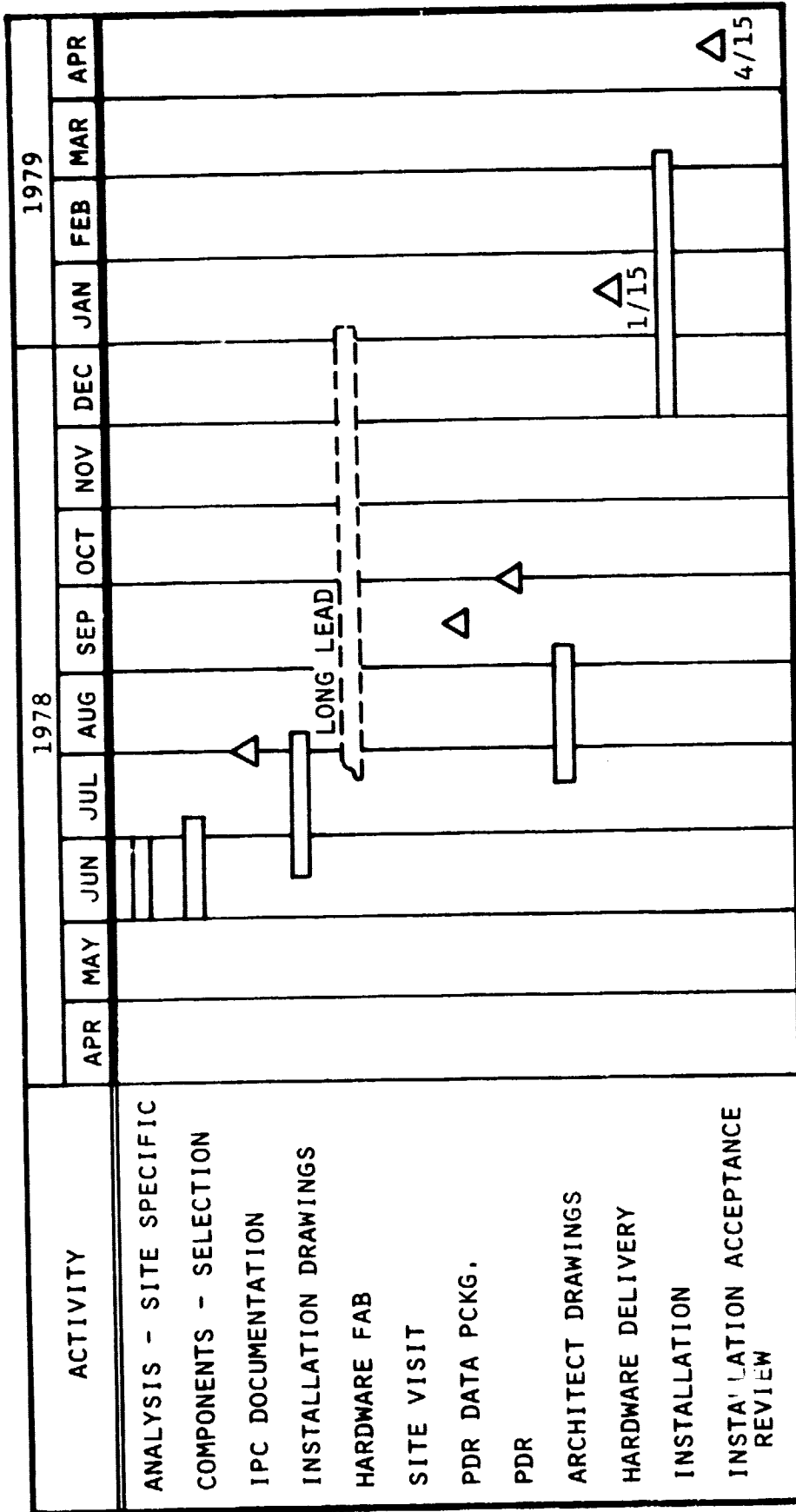
Figure 2-6. Commercial Heating and Cooling (Ocmulgee) (OTS #44)



REVISED BASED ON E.C.P. 005

REVISED 3/31/78

Figure 2-7. Commercial Heating and Cooling (50 Ton Lennox) (OTS #45)



REVISED BASED ON E.C.P. 005

REVISED 3/31/78

Figure 2-8. Commercial Heating and Cooling (Unidentified) (OTS #46)

75 Ton

SECTION III TECHNICAL STATUS

SITE ACTIVITY

Kansas University -- Multifamily Heating and Cooling

The PDR was held at KU on March 22, 1978. The design was approved.

COLLECTOR SUPPORT STRUCTURE

Collector support structure, I-beams, and all collector and header mounting hardware have been ordered for the KU site.

A "Solar Collector and Header Mounting Instructions Outline" and a "Support Structure Assembly Manual" were prepared following the completion of the 28-collector array at the Honeywell Solar Laboratory. The support structure manual prepared by the metal framing manufacturer, resulted from their in-shop assembly of a sample structure section and from their project engineer's visit and review of the Honeywell structure. The outline and manual have become an integral part of the 404 Collector/Header/Structure package.

STORAGE TANK

Final bids were received from Kansas City and Minneapolis area contractors for fabrication and insulation of the KU 8,000-gallon unlined steel storage tank.

After considering cost and performance aspects of fiberglass batt and foam options, urethane foam with weatherproof vapor barrier was chosen as the best candidate.

The lining for the KU tank remains as specified (PreKrete C-17 calcium based cement). However, investigation of other linings continues. An epoxy lining manufactured by Plas-Chem Coating, Chem-Pon 2316, was tested. A sample was immersed in tap water and was maintained at 180°F by an electric oven for 30 days (24 hours/day). No odor nor any discoloration was evident in the water, and there was no visual deterioration of the sample. The water solution will be analyzed. This lining and another promising penolic/epoxy lining (Plasite 7155HHB and 7156) are to be tested in 220°F tap water, with and without a sodium nitrite inhibitor.

New Castle, PA -- Single-Family Heating Only

The site inspection report from the Architect dated March 20, 1978 indicates that general construction is proceeding rapidly as the weather conditions have improved. Installation of the solar heating system has begun with the installation of 22 solar collectors on the upper roof. All parties involved indicate a willingness to proceed on the project as rapidly as possible toward completion of the solar heating system.

Carrollton, TX -- Commercial Heating and Cooling

All initial simulation runs and load studies on the Carrollton building have been completed. The collector field size, collector tilt angle, the storage tank size and performance have been defined. This H/C system is different from the KU system in many areas, thus making complete redesign necessary.

The preliminary plumbing layout and pipe sizing are complete and are now under evaluation.

A preliminary layout of SDAS sensor locations for the Carrollton site has been prepared and sent to IBM and NASA/MSFC for review and comment.

The support structure for the Carrollton site has been designed. The framework is virtually the same as the one for KU. The slope is 20^0 ; the row length is 81 feet (8 rows); and a portion of the A-frames will be pre-assembled/welded (Figure 3-1). Requests for quote have been submitted to metal framing manufacturers for the structure. Mounting hardware has been ordered.

Heating and Cooling Complex Layout

The preliminary layout of the H/C complex was completed and presented to the architect for evaluation. In laying out the equipment, the following considerations were made:

- a) Allow enough space between all units for convenient touring of the complex
- b) Allow enough clearance for servicing the two rankine units and for proper air intake into the cooling water tower.
- c) Minimize all pipe runs to reduce cost
- d) Properly position the purge unit and the water tower to reduce the negative effects that could be caused by their exhaust if it was to blow on the two rankines or into the parking lot.
- e) Make the H/C complex aesthetically pleasing.

Plumbing Layout in the Mechanical Room

The preliminary layout of the hydronic equipment internal to the mechanical room is complete. Figure 3-2 shows an isometric view of this layout.

Ocmulgee National Monument, GA -- Light Commercial Heating and Cooling OTS#44

A preliminary site/system interface meeting was held at the site. The system and its components were described to a group of National Park Service (NPS)

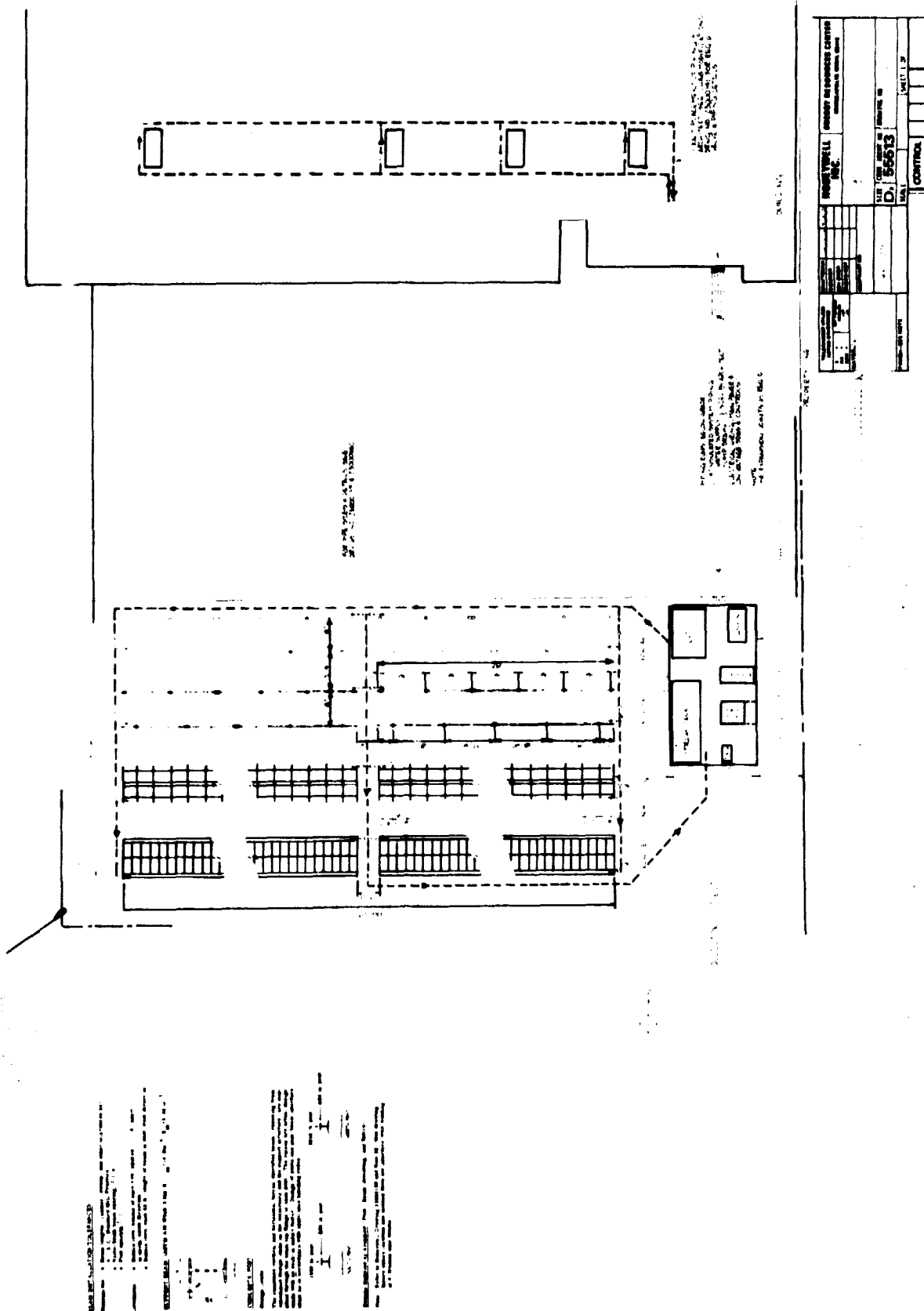


Figure 3-1. Collector Field

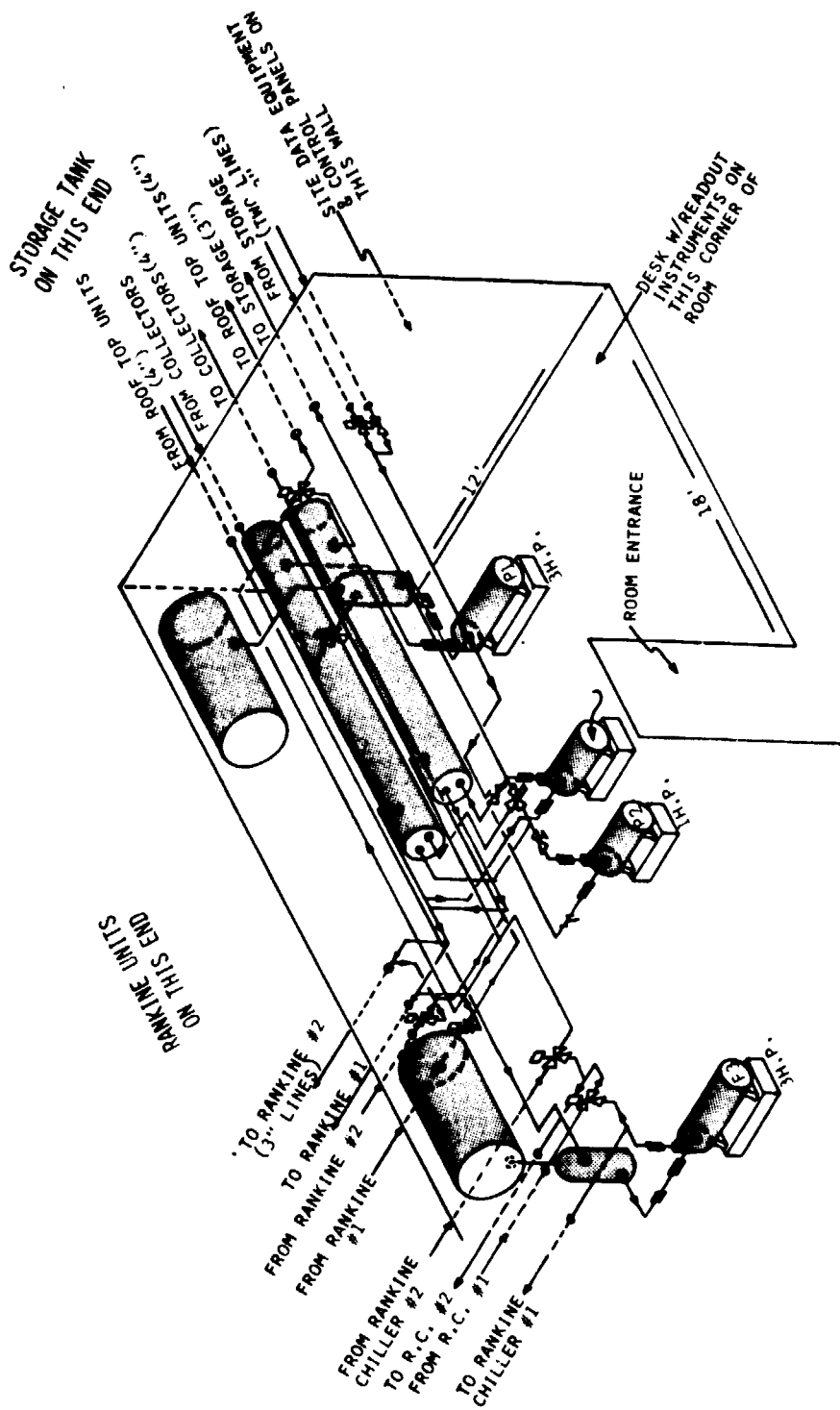


Figure 3-2. Preliminary Schematic of (18' x 12') Mechanical Room

officials, including the monument director and national facilities management. Contact was also made with the A/E firm retained by the NPS. Project organization and scheduling were discussed, and a tentative schedule and division of work was agreed to.

Design work will be scheduled to coincide with that of the A/E.

Sacramento, CA -- Single-Family Heating and Cooling OTS#41

A preliminary review of the site and baseline system has been conducted. Recommended layouts of a mechanical room, system components and piping, and the collector array were sent to the McClellan architect. The proposed mechanical room, added onto the northwest corner of the house, would contain: storage tank, energy transport module, system control panel, SDAS equipment, and the DHW heater. A visit to the Sacramento site is set for mid-April. Scheduled design work by Honeywell engineers and the McClellan architect and engineers will proceed following the coordination meeting.

A preliminary metal framing collector support structure design has been completed for roof-mounting onto the OTS #41 house. Changes in the structure to accommodate single-collector-high rows are required and are being reviewed. The baseline 35-collector array was positioned to avoid shadowing by the house chimney and to keep the collectors from extending northward beyond the roof's peak. Coordination with the architect continues toward the final design.